

## Description

# AUTOMOTIVE VEHICLE WITH LATERAL IMPACT SEAT DISPLACEMENT SYSTEM

### BACKGROUND OF INVENTION

[0001] Field of the Invention

[0002] The present invention relates to a automotive vehicle in which a side impact upon the passenger compartment is managed by using a portion of the impact load to move the occupant seat laterally with respect to vehicle's body.

[0003] Disclosure Information

[0004] As the requirements related to automotive side impact testing have become increasingly more stringent, the design issues needed to be addressed by vehicle designers have become corresponding more demanding. One technical problem deals with the need to reinvent vehicle side structures at a reasonable cost, using designs that are effective. The present invention includes a seat displacement or pusher system including multiple blocks or

brackets constructed of metallic or non-metallic materials such as resin, foams or honeycomb, which may be inserted in the vehicle door in alignment with the seats. The inventive seat displacement system in effect pushes the vehicle seats inboard in an event of an impact to then allow a pelvis pusher or lower portion of the interior trim of the door to push the occupant laterally by engaging the pelvic area of the passenger. This results in acceleration of the occupant as early as possible in a lateral direction with displacement force applied to the pelvic region.

[0005] Traditional side impact barrier systems have focused upon on the reinforcement of vehicle structures such as the B-Pillar, rocker panels, door beams, floorpan etc. Although reinforcement of these structures has provided some benefit, test conditions are migrating to the use of higher and heavier test barriers. In essence, a point has generally been reached at which the increasing cost and weight devoted to side impact resistant structures are yielding fewer benefits because the impact forces to which such structures are subject are so profound as to overwhelm small design changes. For example, even with major changes to the floorpan of a vehicle, the ubiquitous center tunnel prevents the floorpan from exhibiting the column

strength to the extent required to overcome or to compensate for increased forces expected with currently projected testing methods.

[0006] U.S. Patent 5,000,509 discloses a system which attempts to handle lateral intrusion resulting from side impact by strengthening the platforms upon which the seats are mounted as well as the tunnel area of the floorpan, so as to react against a lateral load by a column comprising two seat bases and the tunnel-area floorpan. This design of the '509 patent illustrates prior thinking on crash management which will be ineffective given the newer test requirement, because the design of the '509 patent will not allow the seat to be pushed out of the way so as to permit the occupant of the seat to be contacted first in the pelvic region.

## **SUMMARY OF INVENTION**

[0007] An automotive vehicle includes a passenger cabin being generally symmetrical about a longitudinal center plane and a floorpan defining a lower structural surface of the passenger cabin. A first seat is mounted to the floorpan upon a seat frame and riser with the seat extending laterally across at least a portion of the passenger cabin, with the seat having a frame and an outboard end. A side clo-

sure structure adjoins the outboard end of the seat. A seat displacement member, located within the side closure structure, is adapted to impact the outboard end of the seat, so as to deform the seat frame and the floorpan, which moves the seat laterally inward with respect to the longitudinal center plane of the vehicle in the event of a laterally directed impact load against the closure structure. This will cause the pelvic region of an occupant of the seat to be the first region of the occupant to be dynamically loaded by the side closure structure. In certain cases, this may mean that the pelvic region of the occupant of the seat is the first portion of the occupant's body to be contacted by the side closure structure.

[0008] According to another aspect of the present invention, an automobile preferably comprises a second seat extending laterally across a portion of the cabin not occupied by the first seat, with the first and second seat being separated laterally such that displacement of the first seat resulting from an impact by the seat displacement member upon the first seat will cause the first seat to move laterally closer to the second seat.

[0009] One aspect of the present seat displacement member is its function to prevent the inner and outer panels of a clo-

sure structure, which may comprise either a door or a quarter panel, from collapsing upon one another in the region of the seat displacement member.

[0010] A seat displacement member according to the present invention preferably comprises a rigid block-like structure operatively attached to at least one exterior panel of the side closure structure. Accordingly, the seat displacement member may include a metallic or non-metallic block, or, in another preferred embodiment, a plurality of blocks with a window glass clearance space extending between inboard and outboard blocks.

[0011] According to another aspect of the present invention, an automotive vehicle may include not only a seat displacement member, but also a pelvis pusher block mounted within the closure structure above the location of the seat displacement member.

[0012] According to another aspect of the present invention, a method for managing an impact load directed laterally against the passenger compartment of an automotive vehicle includes the sequential steps of reacting initially to the impact load by permitting partial deformation of a side closure structure having inner and outer panels, while preventing the side closure structure from collapsing in-

ternally; laterally displacing an occupant seat located within the passenger compartment by impact loading the seat with a seat displacement member extending between the partially deformed inner and outer panels of said side closure structure; and, causing an initial dynamic loading of an occupant of the seat by contacting the pelvic region of the occupant with the partially deformed inner panel of the side closure structure. The occupant is preferably contacted by a portion of the inner panel which is located above the portion of the inner panel which contacts the seat during lateral displacement of the seat.

[0013] It is an advantage of the present invention that the occupant of the vehicle will be moved laterally inward by loading the occupant's pelvic region first, rather than by loading a higher region of the occupant's body.

[0014] It is a further advantage of the present invention that the present seat displacement member will allow the occupant seat of a vehicle to be moved laterally inboard during a side impact, so as to allow the occupant's pelvis to be contacted by a pelvis pusher installed as part of side closure structure to which the seat displacement member is mounted.

[0015] Other advantages, as well as objects and features of the

present invention, will become apparent to the reader of this specification.

## **BRIEF DESCRIPTION OF DRAWINGS**

[0016] Figure 1 is a side elevation, partially cut away, of a vehicle showing seat displacement members and pelvis pushers according to the present invention.

[0017] Figure 2 is a end view, partially in section of the vehicle of FIG. 1, with the addition of a test impact barrier.

[0018] Figure 3 is similar to FIG. 2 but shows an impact barrier as having partially collapsed a door having seat displacement members according to the present invention.

[0019] Figure 4 is similar to FIGS. 2 and 3 but shows a later point in the lateral load management sequence according to the present invention.

[0020] Figure 5 illustrates a one piece seat displacement member according to another aspect of the present invention.

## **DETAILED DESCRIPTION**

[0021] As shown in FIG. 1, vehicle 10 has front-end seat occupant 12 and a rear-end seat occupant 14. Passenger cabin 16 of vehicle 10 has a floorpan 18. FIG. 1 shows front and rear seat displacement members 62 which are generally shown as being rectangular. Pelvis pushers 58 are

mounted above seat displacement members 62.

[0022] FIG. 2 shows greater detail of a 2-piece seat displacement member having an outboard member 54 and an inboard member 56. Outboard member 54 is mounted to outer panel 42 of door 40. Inboard seat displacement member 56 is mounted to inner panel 44 of door 40. Impact barrier 20 is shown as in a free state before impacting door 40. It is also noted that glass 52 occupies a clearance space between outboard seat displacement member 54 and inboard seat displacement member 56. Front seat occupant 12 is shown as being seated upon seat cushion 32 which is part of seat 24. Center plane 26 of vehicle is also shown. The vehicle further includes second seat 28. Both seats are mounted upon floorpan 18 by means of risers 30. Cross member 34 is shown as being as extending under floorpan 18 and seat 24. This cross member would also extend under seat 28. Seat displacement members 54 and 56 may comprise metallic or non-metallic blocks or brackets. The nonmetallic compositions may include resin structures or composites, including metals and other materials known to those skilled in the art and suggested by this disclosure.

[0023] FIG. 3 illustrates impact barrier 20 as having collapsed



door 40 such that outer door panel 42 and inner door panel 44 have moved together in the region of outboard seat displacement member 54 and inboard seat displacement member 56. It is also noted that in FIG. 3 that the clearance space for glass 52 has been closed.

[0024] FIG. 4 illustrates a further point in the present sequence in which barrier 20 has fully closed the gap which previously existed between seat 24 and inner panel 44 of door 40. At this point, outboard seat displacement member 54 is stacked upon inboard seat displacement member 56 and the seat displacement members have begun pushing seat 24 laterally by impacting upon seat 24 and seat riser 30. Floorpan 18 has also begun to deform at this point. Although occupant 12 has in effect remained in substantially the position originally occupied vis-à-vis plane 26, seat cushion 32 has moved laterally inboard. Importantly, it is shown in FIG. 4 that the portion of inner panel 44 supported by pelvis pusher 58 has begun contacting the pelvic area of occupant 12. It is thus seen from these sequences that the first portion of the occupant which is contacted by side closure structure 40 is the pelvic region of occupant 12. This is beneficial because the lower portion of the occupant's body will pull the upper portion in-

board as the lateral intrusion progresses.

[0025] It should be noted that the lateral displacement of the first seat as shown in the various figures will cause the first and second seats to move closer together. Thus, it is to be understood that the present automotive vehicle is not intended to create a column loading situation between the adjacent seats 24 and 28. Rather, it is a result of the present invention that seat 24, including the seat risers and associated floorpan structure, will in effect be pushed out of the way so as to allow occupant 12 to be laterally displaced by means of a dynamic load applied by the side closure structure 40 against the pelvic region of the occupant. In effect, this comprises a method according to the present invention in which an impact load directed laterally against the passenger compartment of the vehicle is reacted initially by permitting partial deformation of the side closure structure 40, specifically outer and inner panels 42 and 44, while seat displacement members such as those shown at 54 and 56 prevent side closure structure 40 from collapsing internally.

[0026] The function of a seat displacement member according to the present invention may be enhanced by using a unitary or one-piece member such as that illustrated in FIG. 5.

Unitary seat displacement member 62 extends substantially for the entire distance defined between outer panel 42 and inner panel 44 of side closure structure 40. As noted above, side closure structure 40 may comprise either a movable door hinged about either a horizontal or a vertical axis, or a fixed structure such as a quarter panel. Similarly, as suggested by FIG. 1, the present structural system may be employed either with front or rear passenger seating area of an automotive vehicle.

[0027] In essence, the present inventive method may be viewed as a method for managing an occupant of a automotive vehicle in the event of an impact load directed laterally against the passenger compartment of the vehicle according to the steps of laterally displacing a seat occupied by the occupant without laterally displacing the occupant; by impacting the seat with a seat displacement member located within a side closure structure of the vehicle; and, following lateral displacement of seat, laterally displacing the occupant by contacting occupant in the pelvic region with an interior surface panel of the side closure structure. This interior surface panel may be backed up by the illustrated pelvis pusher 58, or may comprise a panel having suitable padding or other structures for contacting the

pelvic region of an occupant.

[0028] Although the present invention has been described in connection with particular embodiments thereof, it is to be understood that various modifications, alterations, and adaptations may be made by those skilled in the art without departing from the spirit and scope of the invention set forth in the following claims.